ÉCOLE POLYTECHNIQUE FÉDÉRALE DE LAUSANNE

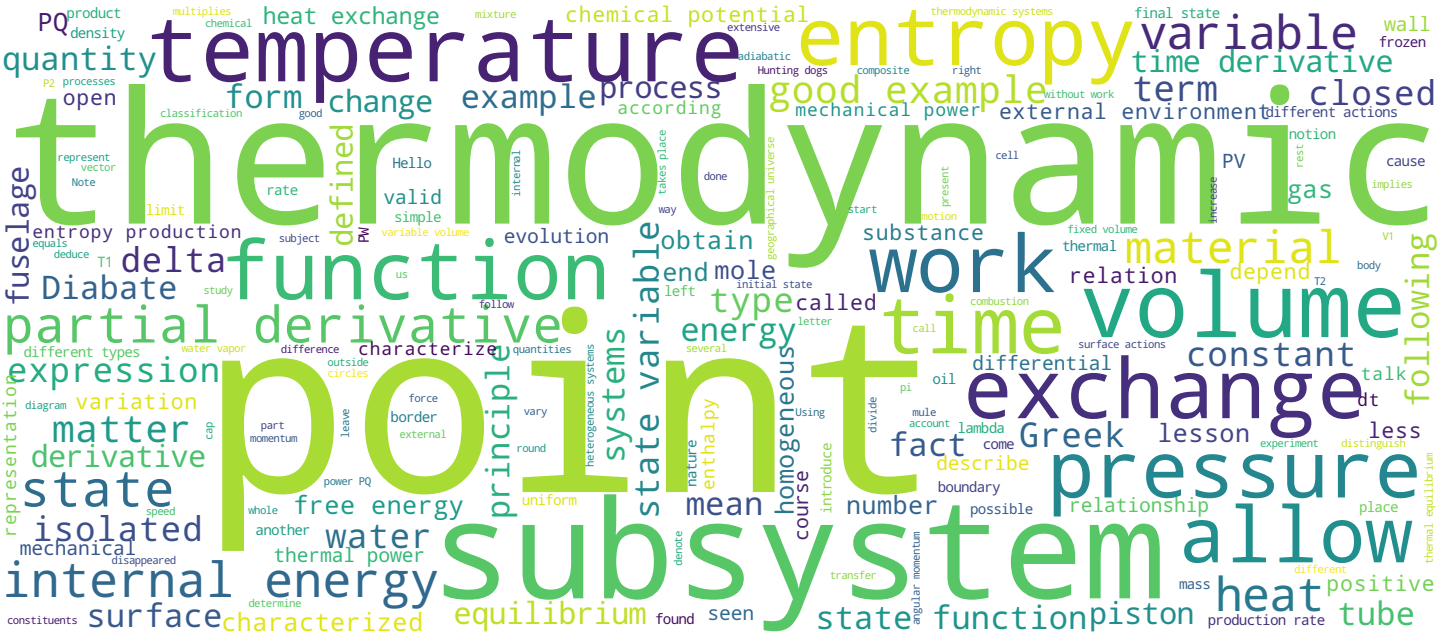
RESCIF
Réseau d'excellence des sciences de l'ingénieur de la Francophonie

Thermodynamique

Système, Actions en surface et Typologie

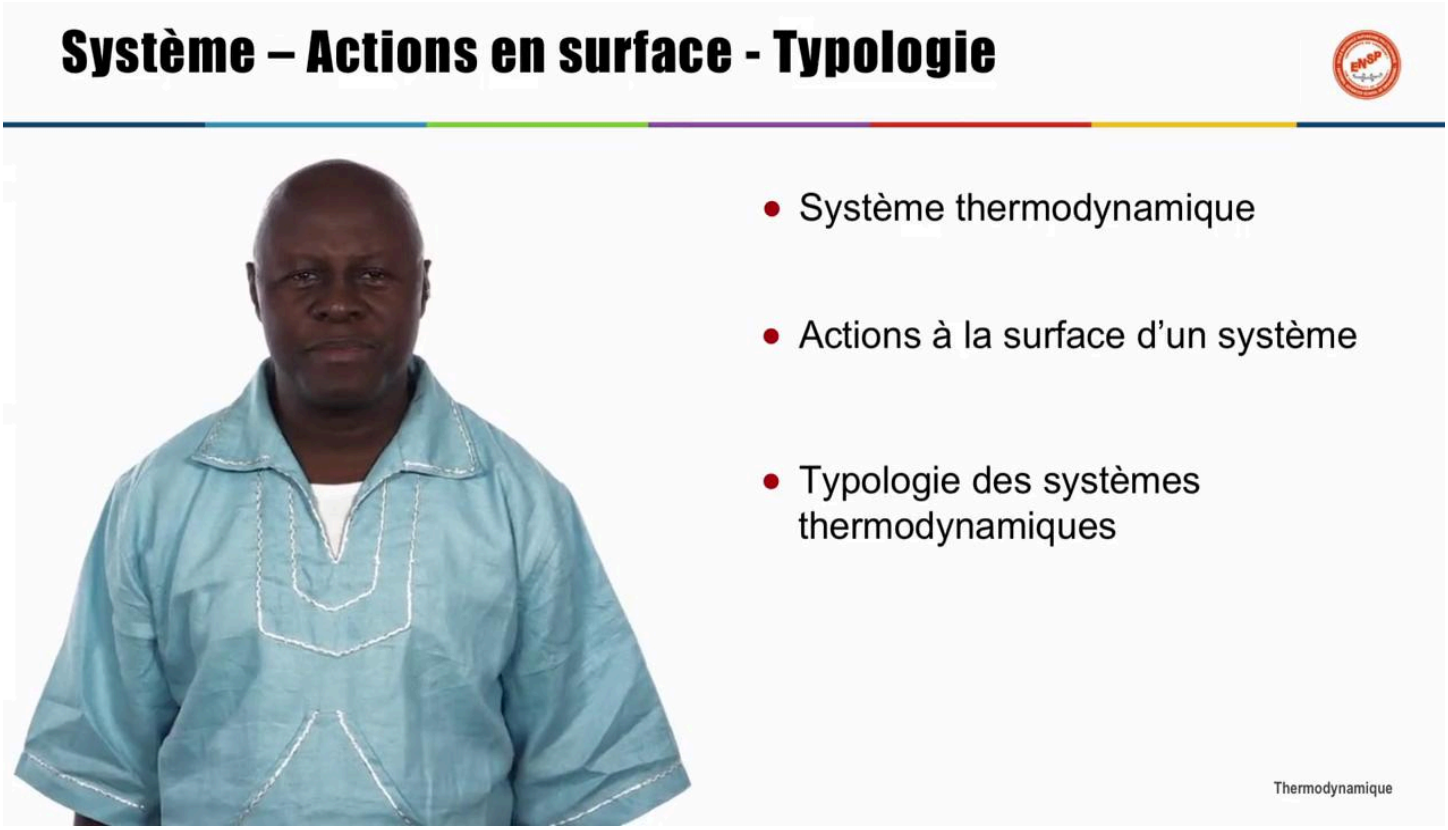
James Joule, 1818-1889

Ing. Dr. Paul-Salomon NGOHE-EKAM



Video

EPFL



Hello. It is still a great pleasure for me to contribute to the word thermodynamic reef for data from the Federal Institute of Technology in Lausanne, Switzerland. I am the ingenious Dr. Paul Salomon from Brighton, a teacher at the École nationale supérieure polytechnique in Yaoundé, Cameroon. This time I will talk to you about the system without knowing it. And typology at the end of that of sound. You are going to be capable of the challenges currently. A thermodynamic system. Following this definition, you can then define the different actions that have takes place at the surface of a thermodynamic system. And at the end of the lesson, you will also be able to define and describe the different types of thermodynamic systems that we encounter.

Notes

Summary

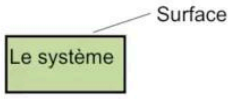
0m 05s

Système thermodynamique

- **Définition**

  Corps, substance (ou partie de la matière) ou ensemble de substances dont on s'intéresse à l'évolution éventuelle avec le temps

  - **Hypothèse** : Le système contient toujours au moins une mole de matière (ordre de grandeur)
  - **Conséquence** : 1 mole → Grand →Décomposition possible en sous-systèmes (et inversement !)



- **Délimitation**

  Parois = Surface = Frontière

Thermodynamique

How can we define a thermodynamic system? We will say that a thermodynamic system is a substance, a body, a quantity of matter which interests the physicist and whose evolution he will study. The thermodynamic system has therefore a defining hypothesis which is to say that this system has a significant amount of of matter, so at least a mole of matter. The immediate consequence of this assumption is that a ball of matter being an important quantity of matter, one will thus be able to discredit or divide a thermodynamic system into several subsystems and vice versa. We can also consider several sub-systems and by forming a set that we will call later a thermodynamic system to be studied. Good. The amount of material that makes up a thermodynamic system, of course, is not infinite, it is limited. Thus, the thermodynamic system will have a limit which will be called the surface or boundary or wall of the thermodynamic system beyond the system and its border which is its surface.

Notes

Summary

1m 06s

Système thermodynamique

- **Définition**

  Corps, substance (ou partie de la matière) ou ensemble de substances dont on s'intéresse à l'évolution éventuelle avec le temps

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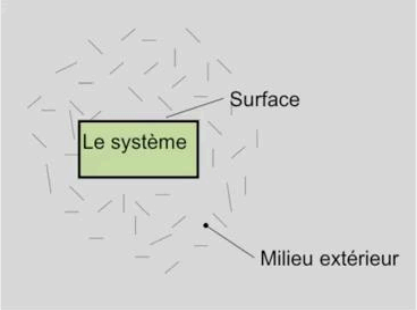
  - **Conséquence** : 1 mole → Grand →Décomposition possible en sous-systèmes (et inversement !)



- **Délimitation**

  Parois = Surface = Frontière

- **Hors des limites**

  Milieu extérieur

- **Système + Milieu extérieur = Univers**

Thermodynamique

Any other quantity of matter constitutes the external environment. Then we have the privilege to specify. That the system as a whole and the lower environments is called universe. But beware, the external environment defined here. Don't introduce him. Thousands, hundreds, of the thousands of galaxies that we can have in the geographical universe. We will leave the theme, the external mix, in any quantity or any part of this geographical universe that is likely to to act or interact with the system. This is what we are going to call the external Miller in thermodynamics. After defining the system, its boundary and the external environment. We will now characterize the different types of systems.

Notes

Summary

2m 32s

Typologie des systèmes thermodynamiques

- Facteurs de classification :

(1) Actions en surface

(2) Constitution interne

Système	Echange de matière	Echange d'énergie	
		Q	W
Isolé	Non	Non	Non
Fermé	Non	Oui	Oui
Ouvert	Oui	Oui	Oui

Thermodynamique

Good. Two main factors are used for the classification of systems. First, we have the surface actions and thus we have the internal constituents of the system, not along the surface actions. And for that, from the types of exchanges that take place through the surface of a system, including a material exchange or an exchange of energy in the form of heat or work. So we will have an articulated type, systems. Thus, for the first type of system, we have an isolated system. An isolated system characterized by the fact that it does not allow any exchange of matter with the outside world, which does not allow any exchange of work. No heat discharge. This is the isolated system. Next to the isolated systems. We have a closed system. The system does not do well the characteristic. Prohibit any exchange of material. Snowy gardens can be possible in the form of heat or work. After the isolated system, the closed system. We now have an open system. The system could have the main characteristic of allowing an exchange of matter, a bit like a tap that, opened, allows water to flow through the faucet. But this is a bad trial to the link heat fields, but also an exchange of work.

Notes

Summary

3m 29s

Typologie des systèmes thermodynamiques

- Facteurs de classification :

(1) Actions en surface

Système	Echange de matière	Echange d'énergie	
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Isolé	Non	Non	Non
Fermé	Non	Oui	Oui
Ouvert	Oui	Oui	Oui
Adiabate	Oui	Non	Oui
Sans travail	Oui	Oui	Non

(2) Constitution interne

Système	Constitution interne	Exemple
Homogène (phase)	Nature des constituants identique en tout point	Vapeur d'eau
Hétérogène	Nature des constituants non identique en tous points	Mélange de deux corps non miscible (Exemple : eau + huile agités)

Thermodynamique

After the open system, we have the system. A. Diabate. The main feature. Diabate, is that he does not theorize or his will does not allow heat exchange. We can have an exchange ideas in the form of work or on a material scale. That's it Ma Diabate. After the Diabate scheme, we have. A system without work. As its name suggests, his specialty is not to allow any work with the mule. Hunting dogs is possible, but also cats of materials. Very well there, it is the characterization of a system according to the exchanges at its border. Now, in relation to the consultants of a system, we have the following characteristics. Firstly. We have a homogeneous system called phases. The nature of the constituents of the homogeneous cells is the same everywhere in the system at any point of the system. And a good example of homogeneous systems is water vapor. Then we have a heterogeneous system for heterogeneous systems. The nature of the constituents is not identical at all points. And a good example of heterogeneous systems, it is the mixture of two immiscible bodies. Like water and oil, but agitated by agitated water. This is a heterogeneous mix. After. A homogeneous system as well as an erogenous engine.

Notes

Summary

5m 15s

Typologie des systèmes thermodynamiques

- Facteurs de classification :

(1) Actions en surface

Système	Echange de matière	Echange d'énergie	
		Q	W
Isolé	Non	Non	Non
Fermé	Non	Oui	Oui
Ouvert	Oui	Oui	Oui
Adiabate	Oui	Non	Oui
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(2) Constitution interne

Système	Constitution interne	Exemple
Homogène (phase)	Nature des constituants identique en tout point	Vapeur d'eau
Hétérogène	Nature des constituants non identique en tous points	Mélange de deux corps non miscible (Exemple : eau + huile agités)
Inhomogène	Propriétés physiques et chimiques continues	Eau avec front de solidification
Composite	Association de phases	Eau + huile au repos
Uniforme	Caractéristiques / propriétés égales en tout point	Pression de l'air en enceinte fermée

Thermodynamique

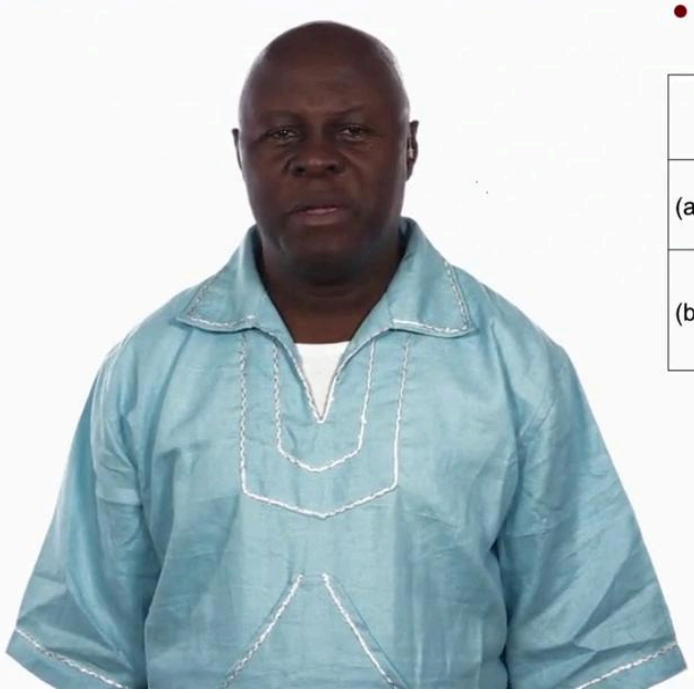
So we can have a system. Inhomogenous. An inhomogeneous system is characterized by the fact that the physical properties and chemicals at the system level are contained. So variable, but continuous. A good example of a homogeneous system. Done. A water in phase of solidification, in the vein of an insulating solidification front for example. The density of this water, which will vary with the bridge, is found after the homogeneous system. So we have. A composite system. A composite system, as its name indicates, is composed of several faces. For example a mixture of oil and water at rest. We have two totally different sides to each other. Called composite system. We will therefore distinguish the system. A shape. The uniform system is characterized by by the fact that its properties are equal at all points. And a good example of a uniform system. And water vapor. Contained in a closed enclosure. Good. After the classification therefore of a system. In particular, taking into account insurance against internal competition. We will now present. We will now talk about the representation of the different systems. Indeed, depending on the exchanges.

Notes

Summary

7m 11s

Typologie des systèmes thermodynamiques



- Types de systèmes et représentation schématique

	Représentation schématique	Système thermodyna-mique	Transfert	Exemple de machine
(a)		Fermé Adiabate Sans travail	- - -	Récipient fermé calorifugé indéformable
(b)		Fermé Non adiabate Sans travail	- Chaleur -	Récipient fermé non calorifugé à volume fixe

Thermodynamique

Authorized at surface level. So first of all we have. This system that is there. For calm. We can see that the inner part which is in fact our system. Is unchanged, so it has a volume. You could say that, which is frozen. The system. It is constituted. From a game. The need in calories. Filing. And our system is completely closed. We see no way out through which we can can buy material or take material out. So here we have a closed system. A. Diabate because of the cap, the fuselage and without work because its volume is frozen. A good example of these systems was being tested. Was closed Talos, rockets and unyielding. This is the case of the Doha oval or the well closed oval. Second type of system. This is a system for which, as seen here in CA, the fuselage has disappeared. The all-closed pass system does not allow any material to leave, but the system allows heat exchange. This is not the letter Q. And no work exchange. The volume of the systems is always fixed. A good example. It is a container closed with water. Broadcast and a fixed volume. This is the case with your juice bottle. Were the refugees whose drought is well weak but under pressure. So no material can come out of the closure.

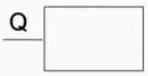
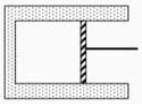
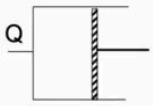
Notes

Summary

9m 04s

Typologie des systèmes thermodynamiques

- Types de systèmes et représentation schématique

	Représentation schématique	Système thermodyna-mique	Transfert	Exemple de machine
(a)		Fermé Adiabate Sans travail	- - -	Récipient fermé calorifugé indéformable
(b)		Fermé Non adiabate Sans travail	- Chaleur -	Récipient fermé non calorifugé à volume fixe
(c)		Fermé Adiabate Avec travail	- - Travail	Récipient fermé calorifugé à volume variable
(d)		Fermé Non adiabate Avec travail	- Chaleur Travail	Récipient fermé non calorifugé à volume variable

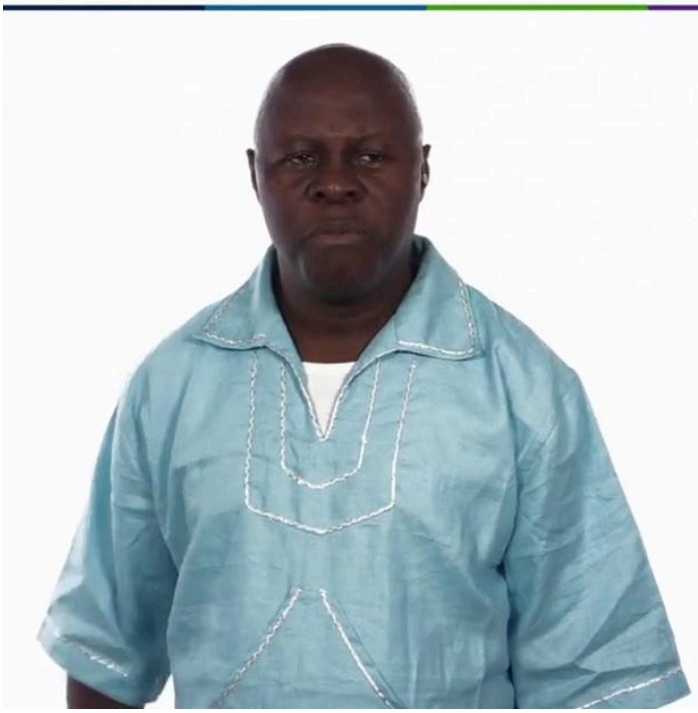
But the system exchanges heat with the mule accelerates. But with a completely fixed volume, not in representation. We have a system. Closed again. There is no opening for the entrance or for the mass exit, the local steering wheel or the fuselages. In the Toulouse system of knowledge. De chaleur looked serious, but we also see that the volume of the system is variable. It was implanted by a piston which allows the volume of the system to be valid. The system does not change, the matter is closed. The system is not heat and DIABATE. The system can exchange tobacco with the cell mixture. A good example of this system. It is a closed container that has water diffused but with variable volume. Fourth performance. We also see that the fuselage has disappeared. The system is well closed, it is not in Diabate. It allows hunting dogs with the mullet quite well, but at the same time the volume is valid in the system and probably with the mule there. Well, the old containers only have to freeze it and at variable volume.

Notes

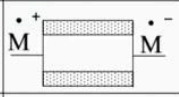
Summary

11m 13s

Typologie des systèmes thermodynamiques



- Types de systèmes et représentation schématique

	Représentation schématique	Système thermody-namique	Transfert	Exemple de machine
(e)		Ouvert Adiabate Sans travail	Masse - -	Tube calorifugé
(f)		Ouvert Non adiabate Sans travail	Masse Chaleur -	Tube non calorifugé Tube de chaudière Tube de Condenseur

Thermodynamique

Next performances. It is a system here on which we see well the fleeting color. The internal volume of the system is not variable. We have there a mass flow one time, a beginning massed on time. Our system is open and allows for the exchange of materials. The system is adiabatic, no heat exchange with the serial environment and the system is rigid, closed at constant volume. It only allows the exchange of work with the cell. A good example of this type of system. It's a broadcast camelot type. You don't have the tubes. Water from flares that conduct air conditioning from one room to another in air enter and exit through the tubes. The tube is rigid. None of the breasts. Women with the mule Celia. The tunnel to the water, the frozen to avoid the monkeys with the mule. The next type of system? It is a system that has opened in all fields of subjects. The white system has diabate, the rate and lightweight systems. The volume of the system is. Note we take the weapons, it is a tube, so let's go the rifle. And we can't let you meet in the boiler or in the combustion in the tube must recover the heat that comes from the combustion and transmit it to the fluids circulating inside the tube.

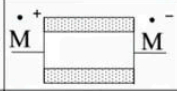
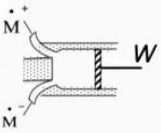
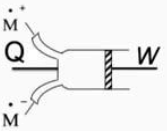
Notes

Summary

12m 43s

Typologie des systèmes thermodynamiques

- Types de systèmes et représentation schématique

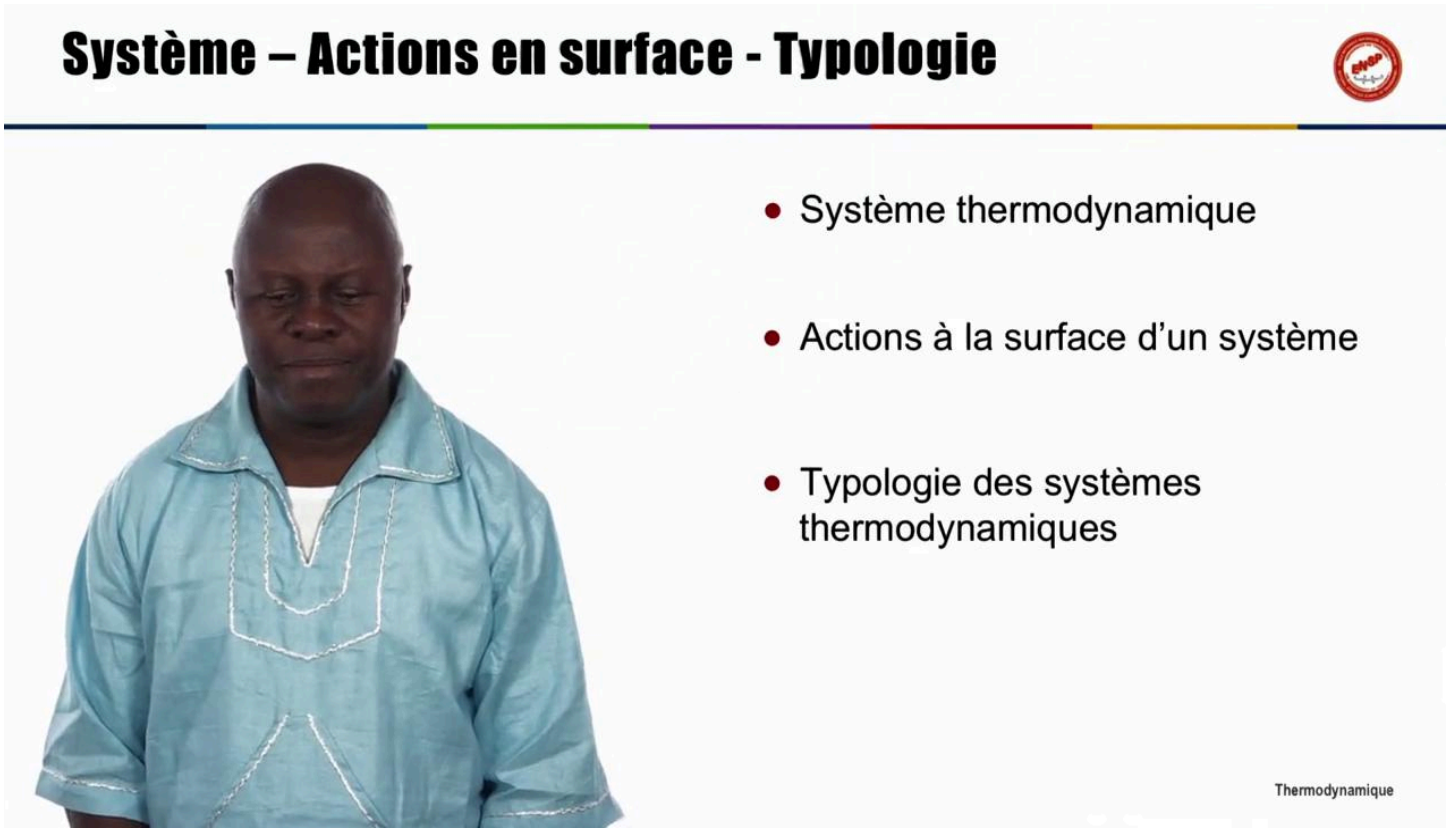
	Représentation schématique	Système thermody-namique	Transfert	Exemple de machine
(e)		Ouvert Adiabate Sans travail	Masse - -	Tube calorifugé
(f)		Ouvert Non adiabate Sans travail	Masse Chaleur -	Tube non calorifugé Tube de chaudière Tube de Condenseur
(g)		Ouvert Adiabate Avec travail	Masse - Travail	Machine à vapeur Pompe alternative
(h)		Ouvert Non adiabate Avec travail	Masse Chaleur Travail	Compresseur à piston Moteur à essence Moteur diesel

For its representation. Here we have the system that allows an open exchange of material. The system allows an exchange of work that has become valid again. But the system is in Diabate. A good example of this system can be found in the steam engine or in the reciprocating pumps. Next system opposed to implementation. Here we have an open system of authorized materials in and out. We have the cap, the fuselage that no longer has the chance to heat. The blue whale is allowed. Here we have a piston that shows us the work fields in Val-Bélair. Cells. A good example of this system and our only piston system. I too your diesel engine to gasoline engine.

Notes

Summary

14m 22s



In conclusion of this study, we retain that we have. Define what a thermodynamic system is. As well as its border and what can be considered its external environment. Then we have. Defines or describes the different actions that can take place at the surface or boundary of Bogdanovic systems. And from the different actions thus defined. We have seen how one can not only. I needed a type of system, too. How to represent the different thermodynamic systems? Thanking you for your attention to this. We believe we have another problem with. Thank you.

Notes

Summary

15m 21s